

REMARKS

This is intended as a full and complete response to the Final Office Action dated October 18, 2006, having a shortened statutory period for response set to expire on January 18, 2007. In view of both the amendments presented above and the following discussion, the Applicants believes all claims are in allowable form.

CLAIM REJECTIONS

A. 35 U.S.C. §103(a) Claims 19-22, 24-26 and 45-46

Claims 19-22, 24-26 and 45-46 are rejected under 35 U.S.C. §103(a) as being unpatentable over Park et al., United States Patent No. 5,478,766 (hereinafter, "Park") in view of Ning et al., United States Patent No. 6,440,753 (hereinafter, "Ning") and section 13.6, figure 13.6 of Van Zant, A Practical Guide to Semiconductor Processing; Semiconductor Services, 1986 (hereinafter, "Van Zant"). In response, the Applicants have amended claims 19, 23, 37, 40-41, 45 and 50 to more clearly recite certain aspects of the invention.

Independent claims 19 and 45 recite elements not taught or suggested by the combination of *Park*, *Ning* and *Van Zant*. *Park* teaches using an etching and an patterning process to form a predetermined structure in a triple-layer film stack on a substrate. However, *Park* is silent regarding how the process steps, control, parameters and overall sequences need to be carried out to form the predetermined structure. Instead, *Park* merely teaches and suggests a 3-mask or 4-mask processes that may be applied to use metal layers as etch stop masks during triple-layer film etching process. *Park* does not teach or suggest a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner

section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19, or etching an upper metal layer of the film stack in a processing chamber to expose a portion of an underlying silicon layer and etching a trench in the silicon layer without removing the substrate from the processing chamber, as recited by claim 45.

Ning teaches etching a metal layer by a patterned photoresist layer. The patterned and etched metal layer may be utilized as an etch mask layer to the subsequent etching process. *Ning* is silent regarding the overall sequence and control necessary to be performed to make the predetermined structure. *Van Zant* merely teaches planar plasma etching that may be utilized to dry etch a material, such as SiO_2 . However, either *Ning* or *Van Zant* teaches or suggests a modification to *Park* that would yield a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19, or etching an upper metal layer of the film stack in a processing chamber to expose a portion of an underlying silicon layer and etching a trench in the silicon layer without removing the substrate from the processing chamber, as recited by claim 45.

As known to those skilled in the art, etchant gas composition and process parameters are most important characteristics of an etch process. Additionally, different etching materials will require a different selection of etchant gas composition and process parameters to promote and encourage the etch

process. *Park*, *Ning* and *Van Zant* are silent regarding the different gas mixtures and process sequence necessary to sequentially etch different materials for forming the desired film stack structure at etch specific process step as claimed by the Applicants. *Park*, *Ning* and *Van Zant* are silent regarding the overall process control necessary to make the etching process effective. Moreover, *Park*, *Ning* and *Van Zant* are silent regarding the etching sequence and methodology how the process sequence may be integrated performed in a chamber without the substrate removal from the chamber, as claimed by the Applicants.

The Applicants submit that each process precursor and/or parameters requires particular design and formula in order to enable the process being performed to obtain a desired processing result. Thus, a careful, thorough, and well researched methodology must be performed in order to identify which precursors and/or parameters will enable successful processes. The integrated etching of a first metal layer and a first silicon layer in a single chamber requires particular arrangement and consideration for the compatibility of the associated process parameters. As such, the Applicants submit that the Examiner is analyzing each element of Applicant's claim separately, rather than considering the claim as a whole, and is neglecting the technical barrier required to develop and enable the claimed invention.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q. 2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 U.S.P.Q. 1941 (Fed. Cir. 1992); M.P.E.P. §2143.01. Moreover, the mere fact that the references could be modified to have produced the claimed invention is not evidence of obviousness unless the references suggest the desirability of the modification. *In re Fritch*, 23 U.S.P.Q. 2d 1780, 1783 (Fed. Cir. 1992), *In re Gordon*, 221 U.S.P.Q. 2d 1125, 1127 (Fed. Cir. 1984). As the teachings of *Park*, *Ning* and *Van Zant* do not teach etching a metal layer and a

silicon layer in a processing chamber and the process sequence control to make the invention and etching process effective, it is not obvious for an ordinary skill in the art to modify these references in a manner that would yield the Applicant's invention.

Thus, the Applicants submit that independent claims 19 and 45 and all depend therefrom are patentable over *Park* in view of *Ning* and in view of *Van Zant*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

B. 35 U.S.C. §103(a) Claim 23

Claim 23 is rejected under 35 U.S.C. §103(a) as being unpatentable over Park, Ning and Van Zant, as applied to claims 19-22, 24-26 and 45-46, and further in view of Wolf. In response, the Applicants have amended claim 19 to more clearly recite certain aspects of the invention.

Independent claims 19 recites elements not taught or suggested by the combination of *Park*, *Ning*, *Van Zant* and *Wolf*. The patentability of claim 19 over *Park*, *Ning*, and *Van Zant* has been discussed above. *Wolf* teaches adjusting a thickness of a spin-on photoresist layer by different spin rotation speed with desired film uniformity. However, *Wolf* fails to teach or suggest a modification to *Park*, *Ning* and *Van Zant* that would yield a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19. As such, a *prima facie*

case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claim 19 and claim 23 depending therefrom are patentable over *Park* in view of *Ning* and in view of *Van Zant* and further in view of *Wolf*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

C. 35 U.S.C. §103(a) Claims 27 and 47

Claims 27 and 47 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Park*, *Ning* and *Van Zant*, as applied to claims 19-23, 25-26 and 45-46, and further in view of *Kabansky* (20020179248). In response, the Applicants have amended claim 19 to more clearly recite certain aspects of the invention.

Independent claims 19 and 45 recite elements not taught or suggested by the combination of *Park*, *Ning*, *Van Zant* and *Kabansky*. The patentability of claim 19 over *Park*, *Ning*, and *Van Zant* has been discussed above. *Kabansky* teaches using dual plasma process in a plasma chamber to remove resist materials and residuals. However, *Kabansky* fails to teach or suggest a modification to *Park*, *Ning* and *Van Zant* that would yield a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19, or etching an upper metal layer of the film stack in a processing chamber to expose a portion of an underlying silicon layer and etching a trench in the silicon layer without removing the substrate from the

processing chamber, as recited by claim 45. As such, a *prima facie* case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claims 19 and 45 and claims 27 and 47 depending therefrom respectively are patentable over *Park* in view of *Ning* and in view of *Van Zant* and further in view of *Kabansky*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

D. 35 U.S.C. §103(a) Claims 28-30, 32-34 and 51

Claims 28-30, 32-34 and 51 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Park*, *Ning* and *Van Zant*, as applied to claims 19-23, 25-26 and 45-46, and further in view of *Nallan* (20020132488). In response, the Applicants have amended claim 19 to more clearly recite certain aspects of the invention.

Independent claims 19 and 50 recite elements not taught or suggested by the combination of *Park*, *Ning*, *Van Zant* and *Nallan*. The patentability of claims 19 and 50 over *Park*, *Ning*, and *Van Zant* has been discussed above. *Nallan* teaches a method for etching a Ta layer. However, *Nallan* fails to teach or suggest a modification to *Park*, *Ning* and *Van Zant* that would yield a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19, or etching a first layer of the film stack in a processing chamber to expose a portion of an underlying second layer, and etching the exposed portion of the second layer

without removing the substrate from the processing chamber, as recited by claim 50. As such, a *prima facie* case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claims 19 and 50 and all claims depending therefrom are patentable over *Park* in view of *Ning* and in view of *Van Zant* and further in view of *Nallan*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

E. 35 U.S.C. §103(a) Claims 31 and 35-36

Claims 31 and 35-36 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Park*, *Ning* and *Van Zant*, as applied to claims 19-23, 25-26 and 45-46, and further in view of *Kropewnicki* (6440864). In response, the Applicants have amended claim 19 to more clearly recite certain aspects of the invention.

Independent claim 19 recites elements not taught or suggested by the combination of *Park*, *Ning*, *Van Zant* and *Kropewnicki*. The patentability of claim 19 over *Park*, *Ning*, and *Van Zant* has been discussed above. *Kropewnicki* teaches using dry etch method to clean a substrate surface. However, *Kropewnicki* fails to teach or suggest a modification to *Park*, *Ning* and *Van Zant* that would yield a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19. As such, a *prima facie* case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claim 19 and claims 31 and 35-36 depending therefrom are patentable over *Park* in view of *Ning* and in view of *Van Zant* and further in view of *Kropewnicki*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

F. 35 U.S.C. §103(a) Claims 37-44 and 48

Claims 37-44 and 48 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Park*, *Ning* and *Van Zant*, as applied to claims 19-23, 25-26 and 45-46, and further in view of *Kropewnicki*, *Perlov* (6283692), and *Chien* (20020192957). In response, the Applicants have amended claim 19 to more clearly recite certain aspects of the invention.

Independent claims 19 and 45 recite elements not taught or suggested by the combination of *Park*, *Ning*, *Van Zant*, *Kropewnicki*, *Perlov* and *Chien*. The patentability of claim 19 over *Park*, *Ning*, *Van Zant*, and *Kropewnicki* has been discussed above. *Perlov* teaches an apparatus utilized to store and move a cassette. *Chien* teaches methods of metal dry etching process. However, *Perlov* and *Chien* fail to teach or suggest a modification to *Park*, *Ning*, *Van Zant* and *Kropewnicki* that would yield a film stack having a patterned photoresist layer having a thinner section formed between thicker sections and disposed over a processing film stack, wherein the thinner portion of the patterned photoresist layer is over a second metal layer, wherein the thinner sections of the patterned photoresist layer is over the second metal layer, wherein the thickness difference between the thin and thick section is sufficient to leave the thicker section of the photoresist layer after the thinner section is removed by an ashing process, and etching a portion of a first metal layer in a processing chamber exposed by the patterned photoresist layer to expose a portion of a first silicon layer, and etching the exposed portion of the first silicon layer in the processing chamber, as recited by claim 19; or etching an upper metal layer of the film stack in a processing chamber to expose a portion of an underlying silicon layer and etching a trench in the silicon layer without removing the substrate from the processing chamber, as

recited by claim 45. As such, a *prima facie* case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claims 19 and 45 and claims 37-44 and 48 depending therefrom are patentable over Park in view of *Ning* and in view of *Van Zant* and further in view of *Kropewnicki, Perlov and Chien*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

G. 35 U.S.C. §103(a) Claim 49

Claim 49 is rejected under 35 U.S.C. §103(a) as being unpatentable over Park, Ning and Van Zant, Kropewnick, Perlov, and Chien as applied to claims 37-44 and 48 and further in view of Minnick (6260894). The Applicants respectfully disagree.

Independent claim 45 recites elements not taught or suggested by the combination of *Park*, *Ning*, *Van Zant*, *Kropewnick*, *Perlov*, *Chien* and *Minnick*. The patentability of claim 45 over *Park*, *Ning*, *Van Zant*, *Kropewnick*, *Perlov*, *Chien* has been discussed above. *Minnick* teaches a blade assembly utilized to transfer a processing substrate in a processing system. However, *Minnick* fails to teach or suggest a modification to *Park*, *Ning*, *Van Zant*, *Kropewnick*, *Perlov* and *Chien* that would yield etching an upper metal layer of the film stack in a processing chamber to expose a portion of an underlying silicon layer and etching a trench in the silicon layer without removing the substrate from the processing chamber, as recited by claim 45. As such, a *prima facie* case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claim 45 and claim 49 depending therefrom are patentable over *Park*, *Ning* and *Van Zant*, *Kropewnick*, *Perlov*, and *Chien* and further in view of *Minnick*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

H. 35 U.S.C. §103(a) Claims 52-53

Claims 52-53 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Park* and further in view of *Wolf*. The Applicants respectfully disagree.

Independent claim 50 recites elements not taught or suggested by the combination of *Park* and *Wolf*. The patentability of claim 50 over *Park* has been discussed above. *Wolf* teaches adjusting a thickness of a spin-on photoresist layer by different spin rotation speed with desired film uniformity. However, *Wolf* fails to teach or suggest a modification to *Park* that would yield etching a first layer of the film stack in a processing chamber to expose a portion of an underlying second layer, and etching the exposed portion of the second layer without removing the substrate from the processing chamber, as recited by claim 50. As such, a *prima facie* case of obviousness has not been established as the references fail to teach or suggest each claimed element.

Thus, the Applicants submit that independent claim 50 and claims 52-53 depending therefrom are patentable over *Park* and *Wolf*. Accordingly, the Applicants respectfully request the rejection be withdrawn and claims allowed.

CONCLUSION

Thus, Applicants submit that all claims now pending are in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issuance are earnestly solicited.

If, however, the Examiner believes that any unresolved issues still exist, it is requested that the Examiner telephone Mr. Keith Taboada at (732) 530-9404 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

Dec 18, 2006


KEITH TABOADA
Attorney Reg. No. 45,150

RESPONSE TO FINAL OFFICE ACTION
Serial No. 10/821,723
Page 18 of 18

Patterson & Sheridan, LLP
595 Shrewsbury Avenue
Suite 100
Shrewsbury, NJ 07702